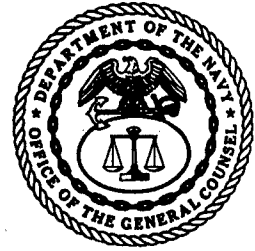




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Attorney Docket No. 85025
Date: 14 March 2006

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Serial Number	11/178,024
Filing Date	8 July 2005
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20060322017

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3 **TELESCOPING BUOYANCY CAPSULE**

4 This application claims the benefit of U.S. Provisional
5 Application Serial Number 60/587716, filed July 12, 2004.
6

7 **STATEMENT OF GOVERNMENT INTEREST**

8 The invention described herein may be manufactured and used by
9 or for the Government of the United States of America for
10 governmental purposes without the payment of any royalties thereon or
11 therefore.

12 **BACKGROUND OF THE INVENTION**

13 **(1) Field of the Invention**

14 The present invention provides a buoyancy capsule sized to
15 contain a weapon for launching. A telescoping nose section of the
16 launch capsule, normally unextended around the weapon, extends at
17 launch along a longitudinal axis of the capsule to provide the
18 buoyancy used to lift the capsule out of a stored state and to ascent
19 the capsule towards the surface. Once the surface is reached, a nose
20 cone of the capsule is jettisoned to allow the weapon to exit the
21 capsule.

22 **(2) Description of the Prior Art**

23 Presently, no weapons/vehicles presently used by the Navy are
24 designed for continuous seawater emersion. Therefore, all existing

1 weapon/vehicles require a protective capsule, especially in the case
2 of aerial missiles and vehicles.

3 Existing capsules are large in size because the capsules
4 integrate the required buoyancy directly into the large size of the
5 capsule, such that the volume of the capsule is usually much larger
6 than the weapon/vehicle it contains. The larger size is needed to
7 provide the buoyancy force that is necessary to lift the
8 weapon/vehicle out of the payload bay and to carry the weapon/vehicle
9 to the surface.

10 Protective capsules must also be capable of withstanding the
11 launch depth pressure. However, based on a given capsule wall
12 thickness, a smaller capsule can withstand greater depth pressures
13 than a large one. Therefore, by minimizing the size of the
14 protective capsule, launch depth capability can be improved.

15 In the Lynch reference (U.S. Patent No. 5,092,222), a launch
16 system is disclosed. The system is a float-up launching system for
17 launching missiles from submerged submarines utilizing a lightweight
18 rigid cylindrical tube 18 telescoped over the missile 14 (FIGS. 1 and
19 2) while stored in the launcher so as to not take up additional
20 volume. At launch, the tube 18 is extended forward of the missile 14
21 by a gas generator 32 to form a floatation chamber 12 (FIGS. 3 and 4)
22 which creates extra buoyancy forward of the missile's center of
23 gravity. At the surface of the water, the floatation chamber 12 is
24 disconnected (FIG. 5) and the missile booster is ignited.

1 In the Vass reference (U.S. Patent No. 4,003,291), a launch
2 apparatus is disclosed. The apparatus launches a plurality of
3 underwater rocket missiles utilizing inflatable bags 30 and a gas
4 bottle 34.

5 In the Brown reference (U.S. Patent No. 3,137, 203), a launch
6 system is disclosed. The missile launching system operates where a
7 capsule 13 containing the missile 14 is ejected from a vertical tube
8 11 of a missile launching submarine. As the capsule 13 leaves the
9 tube 11, a tube 17 is inflated from a supply of air under pressure
10 from accumulators 18.

11 An improvement to existing launching technology would be to
12 provide a capsule that is not significantly larger than the size of
13 the contents of the capsule yet can provide the necessary buoyancy to
14 launch the contents (such as weapons and vehicles). The capsule
15 would telescope a portion of the capsule that completely surrounds
16 the weapon with the portion able to increase the buoyancy of the
17 capsule with the minimal use of gas generation at launch. A launch
18 capsule that minimizes gas generation and use stowage space would be
19 a significant improvement over existing launch capsules.

20 21 SUMMARY OF THE INVENTION

22 It is therefore a general purpose and primary object of the
23 present invention to provide a telescoping capsule that in a stowage
24 state is near in size to the weapon/vehicle that the capsule contains

1 but when activated for launch extends in length to create the
2 necessary buoyancy for a successful deployment.

3 It is a further object of the present invention to provide a
4 capsule that is stored in a collapsed or unextended state in order to
5 save space.

6 It is a still further object of the present invention to
7 provide a capsule that is stored in a collapsed or unextended state
8 in order to save space therefore allowing storage space within the
9 payload module to be conserved.

10 It is a still further object of the present invention to
11 provide a capsule in which launch depth capability is improved by
12 minimizing the size of the protective capsule while maintaining a
13 given wall thickness of comparatively larger capsules.

14 It is a still further object of the present invention to
15 provide a capsule that minimizes gas generation for launching
16 weapons.

17 To attain the objects described, there is provided a
18 telescoping capsule adaptable to be as part of a larger modular
19 payload bay. The telescoping buoyancy capsule is preferably a rigid
20 cylindrical body sized to contain a vehicle or weapon and is designed
21 to withstand depth pressures. The rigid cylindrical body of the
22 capsule also protects the weapon during an ascent to the water
23 surface. Once the surface is reached, a nose cone of the capsule is
24 jettisoned to allow the weapon to exit the capsule.

1 A telescoping nose section allows the volume of the
2 capsule section to be minimized for maximum packing density and
3 allows the volume of the capsule to be increased without
4 increasing the weight of the capsule. The telescoping nose
5 section normally remains unextended around the weapon contained
6 within the capsule. However when extended, the greater volume
7 of the extended telescoping nose section provides the necessary
8 buoyancy used to lift the capsule out of a stored state and to
9 ascent the capsule towards the surface.

10 When the capsule is positioned in a stowage location, the
11 capsule is secured by a latching mechanism which maintains the
12 telescoping nose section in an unextended or collapsed state.
13 The latching mechanism prevents the telescoping nose section
14 from extending until a launch/deployment is initiated. When the
15 latching mechanism is activated to release, the telescoping nose
16 section is free to extend.

17 Once the capsule is loaded into its stowage location and
18 the telescoping nose section is properly latched, the capsule is
19 pressurized at a pressurization valve. The pressurization valve
20 provided on the nose cone pressurizes the capsule with air or an
21 inert gas, based upon the launch requirements of the capsule.
22 In order for the telescoping nose section to extend, the
23 pressure inside the capsule must be set to a greater pressure
24 than what is anticipated at the launch depth. The capsule must

1 be adequately pressurized to overcome pressure at the launch
2 depth and all the frictional forces that act on the capsule.

3 A high pressure air flask is integrated in the capsule to
4 add a small amount of air to compensate for what little may leak
5 past the seals of the capsule. The capsule should already be
6 pressurized through the pressurization valve when the capsule is
7 initially installed within the telescoping buoyancy capsule
8 system.

9 In operation, once the modular payload bay door of a
10 submarine is opened, the telescoping buoyancy capsule is
11 extended to raise the weapon out of the submarine and into the
12 seawater environment. In the seawater environment, the
13 telescoping buoyancy capsule ascends to the surface for a dry
14 weapon/vehicle launch. After the telescoping capsule is
15 sufficiently stabilized, the nose cone is jettisoned and the
16 propulsion system of the weapon is activated to fly the weapon
17 out of the telescoping buoyancy capsule and toward a target.

18 19 **BRIEF DESCRIPTION OF THE DRAWINGS**

20 A more complete understanding of the invention and many of
21 the attendant advantages thereto will be readily appreciated as
22 the same becomes better understood by reference to the following
23 detailed description when considered in conjunction with the
24 accompanying drawings wherein:

1 FIG. 1 shows a cross-sectional view of a telescoping
2 buoyancy capsule of the present invention;

3 FIG. 2 shows an alternate cross-sectional view depicting
4 the capsule release devices of the telescoping buoyancy capsule
5 with the view taken from reference line 2-2 of FIG. 1;

6 FIG. 3 shows an alternate cross-sectional view depicting
7 the roller arrangement of the telescoping buoyancy capsule with
8 the view taken from reference line 3-3 of FIG. 1;

9 FIG. 4 shows an alternate cross-sectional view depicting
10 the guide rails of the telescoping buoyancy capsule with the
11 view taken from reference line 4-4 of FIG. 1; and

12 FIG. 5 shows an alternate cross-sectional view depicting
13 the capsule supports of the telescoping buoyancy capsule with
14 the view taken from reference line 5-5 of FIG. 1.

15 16 DESCRIPTION OF THE PREFERRED EMBODIMENT

17 Referring now to the drawings in detail wherein like numerals
18 indicate like elements throughout the several views, the telescoping
19 buoyancy capsule system 10 of the present invention is shown in FIG.
20 1. In use with a submarine or other undersea platform (not shown), a
21 telescoping buoyancy capsule 20 of the telescoping buoyancy capsule
22 system 10 could be built as part of a larger modular payload bay.

23 The telescoping buoyancy capsule 20 is preferably a rigid
24 cylindrical body sized to contain a vehicle or weapon 100 and is

1 designed to withstand operating depth pressures. The weapon 100
2 may be many sizes, known to those skilled in the art and capable
3 of utilizing the buoyancy that the telescoping buoyancy capsule
4 system 10 provides. The rigid cylindrical body of the capsule
5 20 also protects the weapon 100 during an ascent to the water
6 surface. Once the surface is reached, a nose cone 22 of the
7 capsule 20 is jettisoned or separates to allow the weapon 100 to
8 exit the capsule.

9 The rigid cylindrical body of the capsule 20 also protects
10 the weapon 100 from the corrosive seawater environment as the
11 weapon remains dormant. If the capsule 20 is contained inside a
12 larger watertight container such as a launch tube commonly used
13 on submarines, the capsule does not require the same structural
14 robustness. The large watertight container would provide
15 protection at full operational depths, while the capsule 20 need
16 only provide protection at the designated launch depth. When
17 the large container is flooded to equalize pressure with ambient
18 ocean surroundings, the capsule 20 protects the weapon 100
19 contained inside, such that the capsule gets wet each time the
20 large container is flooded, but contents of the capsule do not.

21 A telescoping nose section 24 allows the volume of the
22 capsule 20 to be minimized for maximum packing density and
23 allows the volume of the capsule to be increased without
24 increasing the weight of the capsule. The telescoping nose

1 section 24 normally remains unextended around the weapon 100
2 contained within the capsule. However when extended, the
3 greater volume of the extended telescoping nose section 24
4 provides the necessary buoyancy used to lift the capsule 20 out
5 of a stored state and to ascent the capsule towards the surface.

6 When the capsule 20 is positioned in a stowage location,
7 the capsule is secured by a latching mechanism 26 which
8 maintains the telescoping nose section 24 in an unextended or
9 collapsed state. The latching mechanism 26 (also shown in FIG.
10 2) prevents the telescoping nose section 24 from extending until
11 a launch/deployment is initiated. When the latching mechanism 26
12 is activated to release, the telescoping nose section 24 is free
13 to extend. Only hydrostatic depth pressure and friction opposes
14 the extension of the telescoping nose section 24, once the
15 latching mechanism 26 is activated and the telescoping nose
16 section is released.

17 Once the capsule 20 is a stowage location and the
18 telescoping nose section 24 is properly latched, the capsule 20
19 is pressurized at a pressurization valve 28. The pressurization
20 valve 28 is provided on the nose cone 22 to pressurize the
21 capsule 20 with air or an inert gas, based upon the launch
22 requirements of the capsule. In order for the telescoping nose
23 section 24 to extend, the pressure inside the capsule 20 must be
24 set to a greater pressure than what is anticipated at the launch

1 depth. The capsule 20 must be adequately pressurized to
2 overcome pressure at the launch depth and all the frictional
3 forces that act on the capsule.

4 A high pressure air flask 30 is integrated in the capsule
5 20 to add a small amount of air to compensate for what little
6 may leak past the seals of the capsule. Alternatively for
7 capsules used for smaller weapons, air can be provided from
8 outside of the capsule. The capsule 20 should already be
9 pressurized through the pressurization valve 26 when the capsule
10 is initially installed within the telescoping buoyancy capsule
11 system 10.

12 Rollers 32 are placed at the top of a launch tube 34 of
13 the telescoping buoyancy capsule system 10. The rollers 32
14 (also shown in FIG. 3) help to reduce friction on the capsule
15 20; which otherwise opposes the ascent of the capsule. The
16 rollers 32 also help minimize the bending force placed on the
17 capsule 20 as the capsule extends out into the flow field around
18 the submarine.

19 The telescoping buoyancy capsule system 10 also includes
20 guide rails 36 are used to help stabilize the capsule 20 and
21 protect the capsule from shock events. The guide rails 36 (also
22 shown in FIG. 4) are compliant in which the compliantness
23 assists in releasing the capsule 20 during a launch. Since the
24 guide rails 36 are compliant and depth pressure sensitive, the

1 guide rails can be properly sized to grip the capsule 20 under
2 atmospheric or low pressures, but then lessen or release their
3 grip at higher launch depth pressures. The guide rails 36 also
4 define annular flow gaps 38 such that as the capsule 20 ascends,
5 seawater is drawn in through the annular flow gaps, filling in
6 behind the capsule as the capsule is displaced upwards. The
7 compliant material is rubberized or includes properties known to
8 those skilled in the art that would make the material compliant.

9 At least one capsule support 40 is positioned at the base
10 of the capsule and attached to the walls of the launch tube 34.
11 The capsule 20 contains a hinged and self-folding capsule
12 support portion 42. The capsule support portion 42 (also shown
13 in FIG. 5) folds in one direction only, since the capsule
14 support portion must support the capsule 20 in the other
15 direction. As soon as the capsule 20 lifts off the capsule
16 support portion 42, the hinged capsule support portion folds
17 down, out of the way, to prevent the capsule support portion
18 from interfering with the ascent of the capsule. The mating
19 capsule support 40 remains stationary attached to the walls of
20 the launch tube 34.

21 In operation, once the modular payload bay door of a submarine
22 is opened, the telescoping buoyancy capsule 20 is extended to raise
23 the weapon 100 out of the submarine and into the seawater
24 environment. In the seawater environment, the telescoping buoyancy

1 capsule 20 ascends to the surface for a dry weapon/vehicle launch.
2 After the telescoping capsule 20 is sufficiently stabilized, the nose
3 cone 22 is jettisoned and the propulsion system of the weapon 100 is
4 activated to fly the weapon out of the telescoping buoyancy capsule
5 20 and toward a target.

6 A major feature of the telescoping buoyancy capsule system
7 10 and the telescoping buoyancy capsule 20 is an unique
8 combination of familiar components. Components are known to
9 exist that would require minor development to adapt them for use
10 in the telescoping buoyancy capsule system 10 and the
11 telescoping buoyancy capsule 20. As a result, none of the
12 individual components require new technology to develop, but as
13 a system and as a individual buoyancy capsule, a new and unique
14 method for launching weapons/vehicles is represented.

15 The use of the telescoping buoyancy capsule 20 greatly
16 improves the packing density of submarine payloads. Because the
17 volume of the capsule 20 is minimized until a launch is called
18 for, the payloads (or capsules) occupy a minimum amount of
19 space. When collapsed, the capsule 20 must only be large enough
20 to contain the weapon/vehicle that the capsule deploys; thereby,
21 differentiating the capsule design from other capsule designs
22 that have the buoyancy built into the size of the capsule. By
23 utilizing the telescoping nose section 24, the volume required
24 for a buoyant ascent is not required until an actual launched is

1 call for. Given a higher packing density of a plurality of the
2 telescoping buoyancy capsules 20 of the present invention,
3 either more weapons/vehicle can be carried on the same size
4 submarine, or the same number of weapons can be carried on a
5 smaller submarine.

6 Also, capsule stability of the maximized by the telescoping
7 nose section 24. The telescoping nose section 24 ensures that
8 the buoyancy is provided at a top 44 where buoyancy is usually
9 needed the most. Buoyancy at or in proximity to the top 44
10 ensures that a maximum distance is maintained between the center
11 of gravity and the center of buoyancy of the telescoping
12 buoyancy capsule 20. The distance between the center of gravity
13 and the center of buoyancy of the telescoping buoyancy capsule
14 20 ensures that the between the center of gravity and the center
15 of buoyancy of the telescoping buoyancy capsule 20 remains
16 upright to be stable during ascent and to be stable on the
17 surface.

18 Furthermore, the design of the telescoping buoyancy capsule 20
19 provides for greater safety. Often gas generators are used for
20 energy storage on submarines. However, explosive materials are
21 required with gas generators that place the submarine and crew at
22 greater risk. Gas generators also add complexity and cost to get the
23 system approved. The telescoping buoyancy capsule 20 of the
24 telescoping buoyancy capsule system 10 are suited to use only

1 compressed air. By using compressed air, no volatile materials are
2 necessary. Submarines routinely use compressed air throughout the
3 submarine, so it is a familiar and relatively safe method for storing
4 energy.

5 Because the telescoping buoyancy capsule 20 is pressurized
6 with air, the telescoping buoyancy capsule has greater depth
7 capacity. The internal air pressure helps to counteract the
8 external hydrostatic water pressures, thereby making the
9 telescoping buoyancy capsule 20 less susceptible to imploding.
10 As a result, the telescoping buoyancy capsule 20 can either be
11 launched at greater depths, or the cylindrical walls of the
12 telescoping buoyancy capsule may be made thinner.

13 As opposed to having the telescoping buoyancy capsule 20
14 constantly charged with high-pressure air, large air flasks, gas
15 generators, or air bag inflators could be used to pressurize and
16 extend the telescoping buoyancy capsule when needed. This
17 charging capacity allows the telescoping buoyancy capsule 20 to
18 remain at atmospheric pressure until a launch/deployment is
19 initiated.

20 Thus, the several aforementioned objects and advantages of
21 the present invention are most effectively attained. Although
22 preferred embodiments of the invention have been disclosed and
23 described in detail herein, it should be understood that this

1 invention is in no sense limited thereby and its scope is to be
2 determined by that of the appended claims.

1 Attorney Docket No. 85025

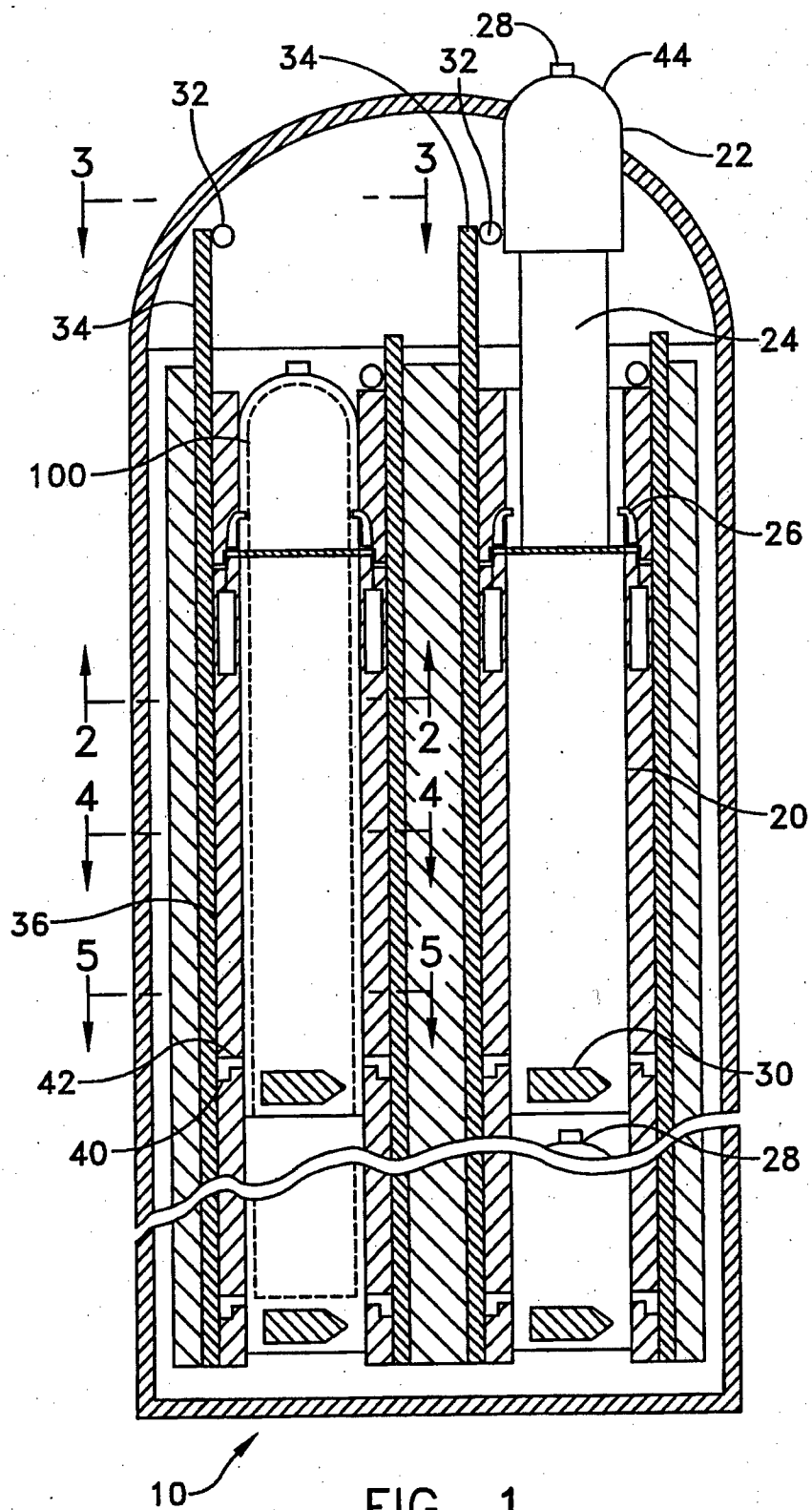
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3 TELESCOPING BUOYANCY CAPSULE

4

5 ABSTRACT OF THE DISCLOSURE

6 The present invention relates to a capsule sized to contain a
7 weapon for launching and to withstand depth pressures. A telescoping
8 nose section of the capsule, normally unextended around the weapon,
9 extends at launch along a longitudinal axis of the capsule to provide
10 the buoyancy used to lift the capsule out of a stored state and to
11 ascent the capsule towards the surface. Once the surface is reached,
12 a nose cone of the capsule is jettisoned to allow the weapon to exit
13 the capsule.



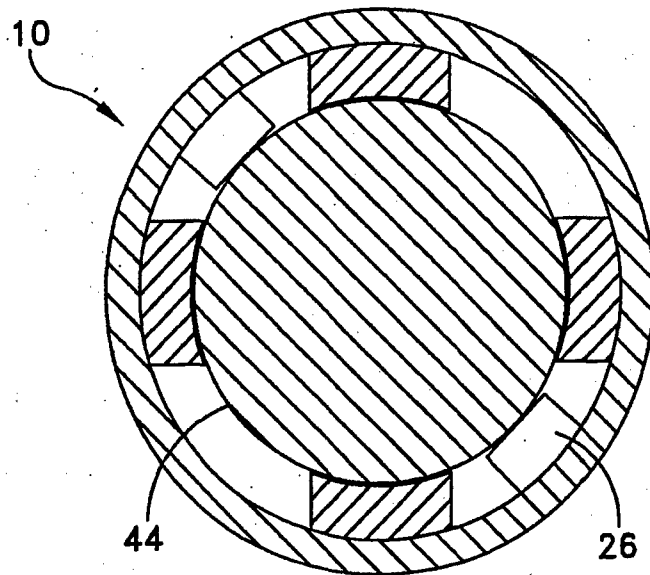


FIG. 2

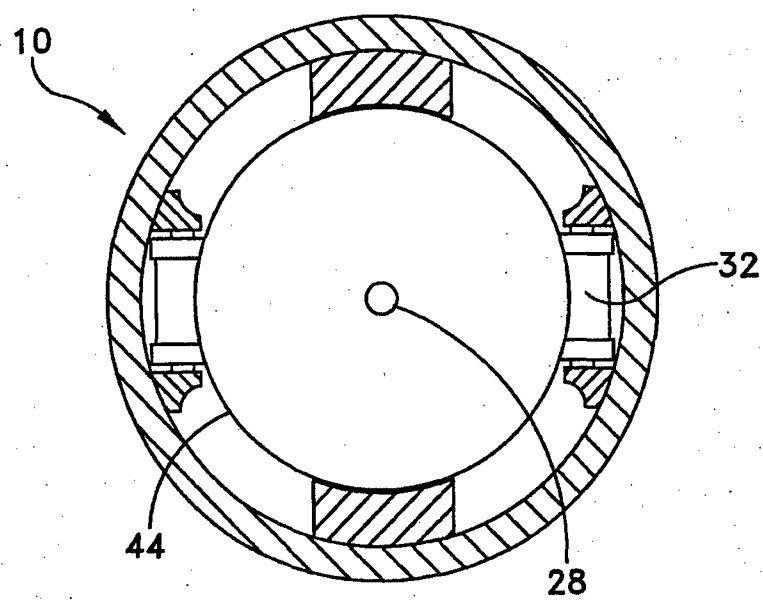


FIG. 3

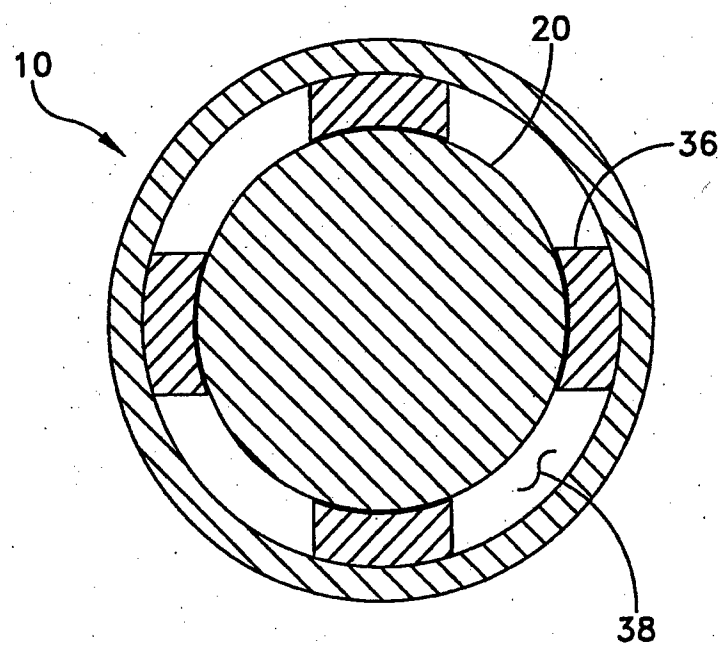


FIG. 4

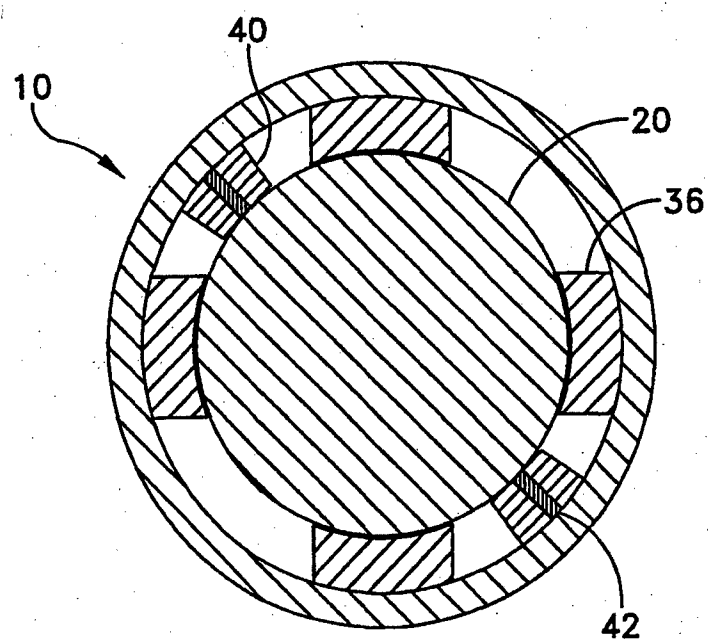


FIG. 5